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USAF BIOENVIRONMENTAL NOISE DATA HANDBOOK. VOLUME 43. F-100F IN--ETC(U)  
OCT 75 J F ROSE, N A FARINACCI  
AMRL-TR-75-50-VOL-43

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AMRL-TR-75-50  
Volume 43



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**USAF BIOENVIRONMENTAL NOISE DATA HANDBOOK**

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**Volume 43**

**F-100F In-Flight Crew Noise**

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AEROSPACE MEDICAL DIVISION  
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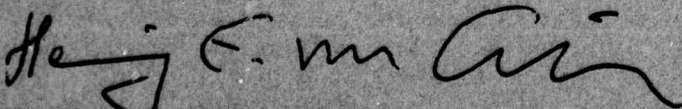
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**FOR THE COMMANDER**



**HENNING E. VON GIERKE**

**Director**

**Biodynamics and Bioengineering Division  
Aerospace Medical Research Laboratory**



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20. ABSTRACT (Continue on reverse side if necessary and identify by block number) The F-100F is a USAF two-seat supersonic fighter-bomber, air-superiority fighter or trainer. This report provides measured data defining the bio-acoustic environments at flight crew locations inside this aircraft during normal flight operations. Data are reported for one location in a wide variety of physical and psychoacoustic measures: overall and band sound pressure levels, C-weighted and A-weighted sound levels, preferred speech interference level, perceived noise level, and limiting times for total		

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daily exposure of personnel with and without standard Air Force ear protectors. Refer to Volume 1 of this handbook, "USAF Bioenvironmental Noise Data Handbook, Vol 1: Organization, Content and Application", AMRL-TR-75-50(1) 1975, for discussion of the objective and design of the handbook, the types of data presented, measurement procedures, instrumentation, data processing, definitions of quantities, symbols, equations, applications, limitations, etc.

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## PREFACE

This report was prepared by the Biodynamic Environment Branch, Aerospace Medical Research Laboratory, under Project/Task 723104, Measurement and Prediction of Noise Environments of Air Force Operations. Col Justus F. Rose, Jr. conducted the field measurements and performed the data analysis; Capt Nick Farinacci and Capt Richard Goeman prepared this report. Noise data are also included that were extracted from noise surveys performed by Lt Col Donald Gasaway, USAF School of Aerospace Medicine. These data describe environments for three test conditions while create noise levels higher than those measured during Aerospace Medical Research Laboratory surveys.

The authors acknowledge the efforts of Mr. John N. Cole who established the data analysis requirements and assisted in the preparation of this report, and Mr. Henry Mohlman and Mr. David Eilerman of the University of Dayton who assisted in the mechanics of data processing.

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## PREFACE

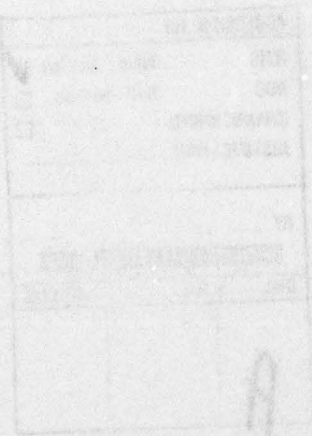
This report was prepared by the Aerospace Environment Branch, Aerospace Medical Research Laboratory under Project Task 1310. Measurement and evaluation of noise environments in an aircraft cabin for the F-105 was conducted. The report contains the results of the measurements and the analysis of the data. The report also includes a description of the test conditions and the test procedures. The data were collected during the flight tests of the F-105. The data were analyzed and the results are presented in this report. The data were collected during the flight tests of the F-105. The data were analyzed and the results are presented in this report.

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## INTRODUCTION

The F-100F is a USAF two-seat supersonic fighter-bomber, air-superiority fighter or trainer manufactured by North American Aviation, Incorporated, Los Angeles and Columbus Divisions. Power is provided by one J57-P-21 or 21A turbojet engine rated at 16,000 lbs maximum take-off thrust with afterburner. The engine is manufactured by the United Aircraft Corporation, Pratt & Whitney Aircraft Division.

This volume provides measured data defining the bioacoustic environments produced inside the aircraft. Such data are essential to evaluate ear protection requirements, limiting personnel exposure times, voice communication capabilities, and annoyance problems associated with operations of the F-100F aircraft.

This volume is one of a series published by the Aerospace Medical Research Laboratory (AMRL) under the same report number (AMRL-TR-75-50) as a multi-volume handbook that quantifies the noise environments produced at flight/ground crew locations and in surrounding communities by operations of Air Force aircraft and aerospace ground equipment. The far-field, community-type, noise data in the handbook describe the noise produced during *ground operations* of aircraft, aerospace ground equipment, and other ground-based equipment or facilities.

Volume 1 of this handbook discusses the objectives and design of the handbook, the types of data presented, measurement procedures, instrumentation, data processing, definitions of quantities, symbols, equations, applications, limitations, etc. Refer to *Volume 1* (reference 1) for such information because it is not repeated in other handbook volumes.

A cumulative index lists those aerospace systems contained in the handbook, and identifies the specific volumes containing each type of environmental noise data available (i.e., in-flight/flight crew and passenger noise, near-field/ground crew noise, far-field/community noise). Volume numbers are assigned sequentially as individual volumes are published. This index is periodically updated as individual volumes are published, and is available upon request from AMRL/BBE, Wright-Patterson AFB, OH 45433. Organizations on the distribution list for the handbook will automatically receive a copy of the updated index as it is generated.

Direct any questions concerning the technical data in this report and other handbook volumes to: AMRL/BBE, Wright-Patterson AFB, OH 45433; Autovon 78-53675 or 78-53664; Commercial (513) 255-3675 or (513) 255-3664.

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1. Cole, John N., *USAF Bioenvironmental Noise Data Handbook, Volume 1: Organization, Content and Application*, AMRL-TR-75-50 (1), Aerospace Medical Research Laboratory, Wright-Patterson Air Force Base, Ohio, 1975.



## IN-FLIGHT NOISE

### MEASUREMENTS

All noise measurements were made on-board a standard-configured F-100F aircraft during typical speed, altitude, and flight maneuver conditions. These levels describe the standard F-100F environments, but may not be representative of those levels encountered if the aircraft has been configured differently (e.g., major equipment or structural changes).

Acoustic measurements were made at one flight crew location. Table 1 lists the measurement location and test conditions as numeric/alphabetic designators which are used on the data pages. The designator 1/A means measurement location 1 and test condition A.

The microphone was randomly moved external to the headgear in a region 0.2-0.3 meter from the head and the resultant samples analyzed using a 4- or 8-second integration time to obtain a power-averaged level that effectively smooths out short-duration fluctuations and best describes the exposure.

### RESULTS

The measured data presented in Table 2 define the sound pressure levels (SPL) produced inside the F-100F aircraft at the specified location. This table includes the overall, 1/3 octave band, and octave band levels. From these data, C-weighted and A-weighted sound levels, maximum permissible time for one exposure per day (AFR 161-35) with and without standard Air Force ear protectors, preferred speech interference level, and perceived noise level are calculated and presented in Table 3. These measures are widely used to assess the effects of noise on personnel and their performance.

TABLE 1

#### MEASUREMENT LOCATION AND TEST CONDITIONS

F-100F, Eglin AFB, 14 Jul 1971  
Serial # 56-3889

LOCATION	POSITION	HEIGHT ABOVE DECK
1	Rear Seat	Seated Head Level
CONDITION	DESCRIPTION	
A	Ground power unit operating, canopy open.	
B	Engine start, ground power unit operating, canopy open.	
C	Taxiing, canopy open.	
D	Idle power setting, canopy open.	
E	Takeoff — afterburner.	
F	Initial acceleration to 300 knots, afterburner, gear and flaps up.	
G	Low altitude cruise — 360 KIAS, 92% RPM, .58M, 3.5M PA.	
H	Typical combat cruise — 460 KIAS, .72M, 95% RPM, 4.0M PA, full console airflow.	
I	Combat cruise — afterburner — 510 KIAS, .82M, 9.4M PA.	



TABLE 1 (Continued)

MEASUREMENT LOCATION AND TEST CONDITIONS

F-100F, Eglin AFB, 14 Jul 1971  
Serial # 56-3889

CONDITION	DESCRIPTION
J	Normal climb — 350 KIAS, .66M, 94% RPM, 10.0M PA ↗
K	Afterburner climb — 400 KIAS, .76M, 16.0M PA ↗
L	Intermediate altitude cruise — 330 KIAS, .73M, 92% RPM, 22.0M PA.
M	Climb — 340 KIAS, .78M, 94% RPM, 22.0M PA ↗ (data at 24.0M PA).
N	Afterburner climb — 350 KIAS, .85M, 26.0M PA ↗
P	High altitude cruise — 315 KIAS, .86M, 92% RPM, 33.0M PA.
Q	Penetration descent — 300 KIAS, .73M, 80% RPM, 33.0M PA ↘ speed brakes and defog.
R	Same as Q plus heat.
S	High speed idle descent — 410 KIAS, 68% RPM, 12.0M → 4.0M PA (no speed brakes).
T	Typical dive bomb pattern — roll-in through release.
U	Typical dive bomb pattern — recovery.
V	Pop-up maneuver — 500' to 5600'.
W	Pop-up maneuver — bomb run.
X	Strafing run — 450 KIAS.
Y	GCA configuration — 170 KIAS, 92% RPM, 3.0M PA, gear and flaps down, defog on.
USAFSAM Survey Kelly AFB, Aug 63	
AA	Normal cruise — 350, KIAS, 90% RPM, 5.0M PA, air on
BB	Normal cruise — 350 KIAS, 90.5% RPM, 5.0M PA, air off
CC	Normal cruise — 350 KIAS, 90.5% RPM, 22.0M PA, console on, deffogger on

TABLE: MEASURED SOUND PRESSURE LEVEL (DB)													IDENTIFICATIONS
2													OMEGA 3.2
NOISE SOURCE/SUBJECT: ( OPERATION: )													TEST 71-014-050
F-100F AIRCRAFT ( )													RUN 01
INFLIGHT NOISE LEVELS ( )													03 JAN 75
( )													PAGE F1
( )													
LOCATION/CONDITION													
FREQ (HZ)	1/A	1/B	1/C MIN	1/C MAX	1/D	1/E	1/F	1/G	1/H	1/I	1/J	1/K	1/L
25	64	79	84	86	83	86	83	83	83	88	98	85	83
31.5	77	81	86	86	81	86	84	84	83	86	96	85	78
40	88	88	87	91	83	95	92	91	91	91	95	90	85
50	74	80	83	90	79	93	90	90	90	88	94	87	82
63	78	87	88	96	84	87	86	86	85	85	92	85	80
80	81	84	81	88	75	85	81	83	82	81	90	80	75
100	83	82	79	85	79	91	86	87	89	86	92	88	83
125	84	83	79	88	74	95	91	91	91	91	92	92	85
160	73	82	83	91	77	95	92	90	90	88	89	89	83
200	76	88	88	94	84	93	91	92	88	86	87	87	82
250	81	88	88	98	86	96	94	93	92	89	88	89	85
315	81	88	88	97	84	98	97	97	96	94	92	95	90
400	77	84	88	94	83	96	95	97	95	96	92	94	88
500	73	84	87	96	83	97	97	97	96	96	94	94	92
630	74	90	92	99	86	98	98	99	98	98	96	97	92
800	69	86	93	100	88	98	98	98	98	99	96	97	93
1000	71	93	95	99	88	96	96	98	97	98	95	97	93
1250	69	91	92	96	86	94	96	96	96	98	94	96	91
1600	69	90	94	100	86	97	97	98	94	96	95	97	92
2000	69	84	88	98	81	97	98	98	95	98	96	97	92
2500	65	85	88	97	83	100	106	106	104	107	100	102	99
3150	63	81	87	96	80	98	101	97	97	97	97	98	92
4000	63	80	87	98	77	94	96	96	92	95	96	98	91
5000	61	75	81	93	73	93	97	99	96	99	96	99	91
6300	57	75	79	93	72	93	95	95	91	95	96	98	92
8000	54	74	77	91	71	91	93	94	88	94	96	98	92
10000	49	70	73	87	68	89	91	93	86	91	96	98	93
12500	46	67	71	86	65	87	89	91	83	88	93	96	92
16000	45	65	69	83	65	86	88	91	83	88	94	95	93
OVERALL	92	100	103	110	97	109	111	111	109	111	109	110	105

LEVEL CORRECTED TO REMOVE BACKGROUND/ELECTRONIC NOISE.







TABLE: MEASURED SOUND PRESSURE LEVEL (DB)													
2													
NOISE SOURCE/SUBJECT: ( OPERATION: ) IDENTIFICATION: )													
F-100F AIRCRAFT ) OMEGA 3.2													
INFLIGHT NOISE LEVELS ) TEST 71-014-050													
( ) RUN 01													
( ) 03 JAN 75													
( ) PAGE J1													
LOCATION/CONDITION													
FREQ (HZ)	1/A	1/B	1/C MIN	1/C MAX	1/D	1/E	1/F	1/G	1/H	1/I	1/J	1/K	1/L
31.5	88	89	90	93	87	96	93	92	92	94	101	92	88
63	83	89	90	97	86	94	92	92	91	90	97	89	84
125	86	87	85	93	82	99	95	95	95	94	96	95	88
250	85	93	93	101	89	100	99	99	98	96	94	97	91
500	80	92	94	102	89	102	102	102	101	102	99	100	95
1000	74	96	98	103	92	101	101	102	102	103	100	101	97
2000	72	92	96	103	89	103	107	107	105	108	102	104	100
4000	67	84	90	101	82	100	103	102	100	102	101	103	96
8000	59	78	82	95	75	96	98	99	93	98	101	103	97
16000	49	69	73	88	68	90	92	94	86	91	96	98	95
OVERALL	92	100	103	110	97	109	111	111	109	111	109	110	105

TABLE: MEASURED SOUND PRESSURE LEVEL (DB)											IDENTIFICATION:	
2												
NOISE SOURCE/SUBJECT:											OMEGA 3.2	
( OPERATION:											TEST 71-014-050	
(											RUN 02	
F-100F AIRCRAFT											03 JAN 75	
(												
INFLIGHT NOISE LEVELS											PAGE J2	
(												
FREQ (HZ)	LOCATION/CONDITION											
	1/M	1/N	1/P	1/Q	1/R	1/S	1/T	1/U	1/V	1/W	1/X	1/Y
31.5	90	88	87	93	91	96	97	100	94	93	92	96
63	86	85	83	89	89	91	93	93	91	91	90	96
125	90	89	88	89	89	94	99	98	95	94	93	92
250	93	91	89	88	89	100	98	101	96	102	98	91
500	96	96	93	96	96	104	102	106	100	105	104	95
1000	97	97	95	98	98	103	101	106	103	104	102	95
2000	100	99	99	100	100	98	100	107	108	103	109	105
4000	97	96	94	99	100	96	94	101	102	100	102	101
8000	98	97	96	103	105	100	89	96	97	94	97	97
16000	96	96	96	110	111	105	89	94	92	90	92	96
OVERALL	106	105	104	112	113	111	108	112	111	111	112	109

TABLE: MEASURED SOUND PRESSURE LEVEL (DB)				IDENTIFICATION:
2	OCTAVE BAND			
NOISE SOURCE/SUBJECT: ( OPERATION: )				OMEGA 3.2
F-100F AIRCRAFT				TEST 71-014-050
INFLIGHT NOISE LEVELS				RUN 02
USAFSAM SURVEY - AUG 1963				04 NOV 77
				PAGE F1
LOCATION/CONDITION				
FREQ (HZ)	1/AA	1/BB	1/CC	
63	91	96	104	
125	94	101	105	
250	97	103	103	
500	100	105	109	
1000	105	105	110	
2000	105	108	111	
4000	102	107	116	
8000	92	97	117	
OVERALL	110	114	121	
LEVEL CORRECTED TO REMOVE BACKGROUND/ELECTRONIC NOISE.				



TABLE: MEASURES OF HUMAN NOISE EXPOSURE													IDENTIFICATION:	
3													OMEGA 3.2	
NOISE SOURCE/SUBJECT:													TEST 71-014-050	
( OPERATION:													RUN 01	
( F-100F AIRCRAFT													28 APR 76	
( INFLIGHT NOISE LEVELS													PAGE H1	
(														
LOCATION/CONDITION														
1/A	1/B	1/C	1/C	1/D	1/E	1/F	1/G	1/H	1/I	1/J	1/K	1/L		
		MIN	MAX											
HAZARD/PROTECTION														
C-WEIGHTED OVERALL SOUND LEVEL (OASLC IN DB) AT EAR														
A-WEIGHTED OVERALL SOUND LEVEL (OASLA IN DB) AT EAR														
MAXIMUM PERMISSIBLE TIME (T IN MINUTES) FOR ONE EXPOSURE PER DAY (AFR 161-35, JULY 73)														
NO PROTECTION														
OASLC	91	100	102	109	97	109	110	109	111	108	109	104		
OASLA	82	99	102	109	95	108	111	109	111	108	110	105		
T	679	36	21	6	71	8	4.5	6	4.5	8	5	13		
HGU-2A/P HELMET WITH H-154														
OASLA*	77	85	86	95	82	94	94	93	94	94	96	91		
T	960	404	339	71	679	85	85	71	101	85	60	143		
HGU-2A/P HELMET WITH H-154(A)														
OASLA*	73	82	83	90	78	90	89	88	88	86	87	83		
T	960	679	571	170	960	170	202	202	240	339	285	571		
HGU-2A/P HELMET WITH CUSTOM LINER														
OASLA*	79	93	96	102	90	101	101	100	101	98	100	96		
T	960	101	60	21	170	25	25	30	25	42	30	60		
COMMUNICATION														
PREFERRED SPEECH INTERFERENCE LEVEL (PSIL IN DB)														
PSIL	75	93	96	103	90	102	103	104	103	100	102	98		
ANNOYANCE														
PERCEIVED NOISE LEVEL, TONE CORRECTED (PNLT IN PNDB)														
TONE CORRECTION (C IN DB)														
PNLT	97	112	115	123	108	122	127	129	126	123	125	121		
C	1	2	1	1	1	0	2	3	3	1	1	2		
* BASED ON CALCULATED SPL SPECTRUM UNDER PROTECTIVE DEVICE.														

TABLE: MEASURES OF HUMAN NOISE EXPOSURE													IDENTIFICATION:
3													OMEGA 3.2
													TEST 71-014-050
NOISE SOURCE/SUBJECT: ( OPERATION: )													RUN 02
F-100F AIRCRAFT ( )													28 APR 76
INFLIGHT NOISE LEVELS ( )													PAGE M2
LOCATION/CONDITION													
1/M	1/N	1/P	1/Q	1/R	1/S	1/T	1/U	1/V	1/W	1/X	1/Y		
HAZARD/PROTECTION													
C-WEIGHTED OVERALL SOUND LEVEL (OASLC IN DB) AT EAR													
A-WEIGHTED OVERALL SOUND LEVEL (OASLA IN DB) AT EAR													
MAXIMUM PERMISSIBLE TIME (T IN MINUTES) FOR ONE EXPOSURE PER DAY (AFR 161-35, JULY 73)													
NO PROTECTION													
OASLC	105	104	103	108	108	109	108	112	111	110	112	108	
OASLA	105	104	103	109	109	108	106	112	111	109	112	109	
T	13	15	18	6	6	8	11	3.8	4.5	6	3.8	6	
HGU-2A/P HELMET WITH H-154													
OASLA*	92	92	91	103	103	99	93	97	93	96	95	92	
T	120	120	143	18	18	36	101	50	101	60	71	120	
HGU-2A/P HELMET WITH H-154(A)													
OASLA*	83	82	81	84	85	91	89	92	88	92	89	83	
T	571	679	807	480	404	143	202	120	240	120	202	571	
HGU-2A/P HELMET WITH CUSTOM LINER													
OASLA*	96	95	94	96	97	102	101	105	101	103	102	95	
T	60	71	85	60	50	21	25	13	25	18	21	71	
COMMUNICATION													
PREFERRED SPEECH INTERFERENCE LEVEL (PSIL IN DB)													
PSIL	98	97	96	98	98	102	101	106	104	104	105	98	
ANNOYANCE													
PERCEIVED NOISE LEVEL, TONE CORRECTED (PNLT IN PNDB)													
TONE CORRECTION (C IN DB)													
PNLT	121	120	120	121	121	120	120	127	129	122	130	125	
C	2	2	2	2	1	1	2	2	3	1	4	2	
* BASED ON CALCULATED SPL SPECTRUM UNDER PROTECTIVE DEVICE.													

\* BASED ON CALCULATED SPL SPECTRUM UNDER PROTECTIVE DEVICE.



MEASURES OF HUMAN NOISE EXPOSURE				IDENTIFICATION:
TABLE:				
3				OMEGA 3.2
NOISE SOURCE/SUBJECT:	OPERATION:			TEST 71-014-050
F-100F AIRCRAFT	(			RUN 02
INFLIGHT NOISE LEVELS	(			04 NOV 77
USAFSAM SURVEY - AUG 1963	(			PAGE H1
1/AA	1/B8	1/CC	LOCATION/CONDITION	
HAZARD/PROTECTION				
G-WEIGHTED OVERALL SOUND LEVEL (OASLC IN DB) AT EAR				
A-WEIGHTED OVERALL SOUND LEVEL (OASLA IN DB) AT EAR				
MAXIMUM PERMISSIBLE TIME (T IN MINUTES) FOR ONE EXPOSURE PER DAY (AFR 161-35, JULY 73)				
NO PROTECTION				
OASLC	109	113	120	
OASLA	110	113	121	
T	5	3.2	P	
HGU-2A/P HELMET WITH H-154				
OASLA*	92	98	107	
T	120	42	9	
HGU-2A/P HELMET WITH H-154(A)				
OASLA*	88	93	96	
T	240	101	60	
HGU-2A/P HELMET WITH CUSTOM LINER				
OASLA*	102	104	108	
T	21	15	8	
COMMUNICATION				
PREFERRED SPEECH INTERFERENCE LEVEL (PSIL IN DB)				
PSIL	103	106	110	
ANNOYANCE				
PERCEIVED NOISE LEVEL (PNL IN PNDB)				
PNL	122	126	134	

\* BASED ON CALCULATED SPL SPECTRUM UNDER PROTECTIVE DEVICE.  
P ADDITIONAL EAR PROTECTION REQUIRED.